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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Scheuten, et al.

Serial No.: 10/574,633

Filed: April 03, 2006

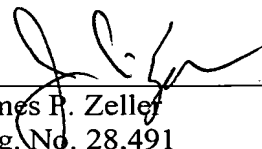
For: SPHERICAL OR GRAIN-SHAPED SEMICONDUCTOR ELEMENT FOR USE IN SOLAR CELLS AND METHOD FOR PRODUCING THE SAME; METHOD FOR PRODUCING A SOLAR CELL COMPRISING SAID SEMICONDUCTOR ELEMENT AND SOLAR CELL

Group Art Unit: To be assigned

Examiner: To be assigned

) I hereby certify that this paper (or fee) is being  
) deposited with the United States Postal  
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) to: Commissioner for Patents, P.O. Box 1450,  
) Alexandria, VA 22313-1450

) September 25, 2006

  
James R. Zeller  
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**SUBMISSION OF TRANSLATION INTERNATIONAL REPORT  
ON PATENTABILITY**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

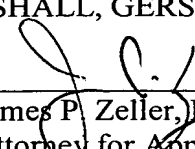
Sir:

Submitted herewith is an English translation of the international preliminary report on patentability.

Respectfully submitted,

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September 25, 2006

# TRANSLATION

## PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

|   |   |   |
|---|---|---|
| Applicant's or agent's file reference<br><b>SCG5301PT-WO</b>  | <b>FOR FURTHER ACTION</b> See Form PCT/IPEA/416                 |   |
| International application No.<br><b>PCT/EP2004/010615</b>   | International filing date (day/month/year)<br><b>22.09.2004</b> | Priority date (day/month/year)<br><b>02.10.2003</b> |
| International Patent Classification (IPC) or national classification and IPC<br><b>H01L31/032 H01L31/0352 H01L31/0336</b> |   |   |
| Applicant<br><b>SCHEUTEN GLASGROEP</b>  |   |   |

|   |  |
|---|--|
| <p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>8</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>13</u> sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. 1 and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p> |  |
| <p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input checked="" type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>  |  |

|  |                                   |
|--|-----------------------------------|
| Date of submission of the demand         | Date of completion of this report |
| Name and mailing address of the IPPEA/EP | Authorized officer                |
| Facsimile No.                            | Telephone No.                     |

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/EP2004/010615

Box No. 1

Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language \_\_\_\_\_ which is the language of a translation furnished for the purposes of:
- ☐ international search (Rule 12.3 and 23.1(b))
- ☐ publication of the international application (Rule 12.4)
- ☐ international preliminary examination (Rule 55.2 and/or 55.3)
2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1, 2, 5-21 \_\_\_\_\_ as originally filed/furnished
- pages\* 3, 3a, 4 \_\_\_\_\_ received by this Authority on 26.07.2005 with telefax
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the claims:
- nos. \_\_\_\_\_ as originally filed/furnished
- nos.\* \_\_\_\_\_ as amended (together with any statement) under Article 19
- nos.\* 1-40 \_\_\_\_\_ received by this Authority on 26.07.2005 with telefax
- nos.\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the drawings:
- sheets 1/2, 2/2 \_\_\_\_\_ as originally filed/furnished
- sheets\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- sheets\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) -- see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (specify): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (specify): \_\_\_\_\_
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (specify): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (specify): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. IV

Lack of unity of invention

1. ☐ In response to the invitation to restrict or pay additional fees the applicant has:
- ☐ restricted the claims.
  - ☐ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☐ neither restricted the claims nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:
- ☐ complied with.
  - ☒ not complied with for the following reasons:

The present application does not meet the requirement of unity of invention pursuant to PCT Rules 13.1, 13.2 and 13.3.

The subject matter of independent claims 1, 10, 21, 28 and 40 of various categories do not fulfill the unity of invention combination conditions stipulated in the PCT Guidelines PCT/GL/ISPE/1 (11 March 2004) Chapters 10, 10.12 and 10.13. The method according to claim 1 is, in fact, not particularly well adapted to producing the spherical semiconductor component in claim 10, since the substrate core in claim 1 does not necessarily consist of soda lime glass, nor the back contact layer necessarily of molybdenum. The same applies to the method according to claim 21 and the solar cell according to claim 28, since here too, the spherical semiconductor components do not seem to correspond to the spherical semiconductor components according to claim 10 (again, the soda lime glass and the molybdenum back contact layer are not mentioned). Therefore, there is no unity of invention between the solar cell according to claim 28 and the photovoltaic module according to claim 40 on one hand, and the spherical semiconductor components according to claim 10 for producing a solar cell, on the other.

4. Consequently, this report has been established in respect of the following parts of the international application:

- ☒ all parts.
- ☐ the parts relating to claims Nos. \_\_\_\_\_

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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| Box No. V   | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability:<br>citations and explanations supporting such statement |      |     |
|---|--|------|-----|
| <b>1. Statement</b>   |  |      |     |
| Novelty (N)   | Claims   | 1-40 | YES |
|   | Claims   |      | NO  |
| Inventive step (IS)   | Claims   | 1-40 | YES |
|   | Claims   |      | NO  |
| Industrial applicability (IA)   | Claims   | 1-40 | YES |
|   | Claims   |      | NO  |
| <b>2. Citations and explanations (Rule 70.7)</b>  |  |      |     |
| <p>1.) This report makes reference to the following documents:</p> <p>D1: EP-A-940860 (NAKATA JOSUKE) 8 September 1999</p> <p>D2: US-A-5 578 503 (PROBST VOLKER ET AL) 26 November 1996</p> <p>D3: US-A-4 173 494 (JOHNSON ELWIN L ET AL) 6 November 1979</p> <p>2.) The present application meets the requirements of PCT Article 33(2) and (3) because the subject matter of independent claim 1 is novel and inventive.</p> <p>D1 is regarded as the prior art closest to the subject matter of claim 1. It discloses a method for producing a spherical semiconductor component for use in a solar cell, involving the following steps:</p> <p>a) applying a conductive back contact layer to a spherical substrate core, and</p> <p>b) applying a CuInSe<sub>2</sub> layer to said conductive back contact layer (see D1; paragraphs 11, 12 and 77).</p> |  |      |     |

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability:  
citations and explanations supporting such statement

Therefore, the subject matter of claim 1 differs from the method known from D1 in that the deposition of the  $\text{CuInSe}_2$  ( $\text{CuInS}_2$ ) compound semiconductor layer is precisely defined in D1 (deposition of a first Cu and a second In precursor layer and conversion of the precursor layers with sulfur and/or selenium to form a  $\text{CuInSe}_2$  ( $\text{CuInS}_2$ ) compound semiconductor layer).

D2 discloses a method for producing a I-III-VI compound semiconductor layer wherein individual layers of the elements copper, indium or gallium, and sulfur or selenium are applied to a flat substrate and then heated rapidly in order to convert the layers (see D2, claim 1).

The production method according to claim 1 differs from the deposition method according to D2 in that the conversion takes place in a melt of the conversion element Se or S or in hydrogen compounds of the conversion element Se or S, after a first Cu and a second In precursor layer are deposited.

This type of conversion is therefore novel and is not obvious from D2 to a person skilled in the art. Therefore, an obvious combination of the teachings of D1 and D2 is excluded.

Consequently, the subject matter of claim 1 is regarded as novel and inventive (PCT Article 33(2) and (3)).

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability:  
citations and explanations supporting such statement

3.) Claims 2-9 are dependent on claim 1 and therefore likewise meet the PCT requirements for novelty and inventive step.

4.) The present application meets the requirements of PCT Article 33(2) and (3), because the subject matter of claim 10 is novel and inventive.

D1 is regarded as the prior art closest to claim 10. It discloses a spherical semiconductor component for use in solar cells, the semiconductor component having a spherical substrate core coated with a conductive back contact layer and a  $\text{CuInSe}_2$  compound semiconductor layer (see D1; paragraphs 11, 12 and 77).

Therefore, the subject matter of claim 10 differs from the semiconductor component known from D1 in that the substrate core is made of soda lime glass and the back contact layer of molybdenum.

These special features of the semiconductor component according to claim 10 are not known from the cited prior art. Although soda lime glass substrates and molybdenum electrodes for  $\text{CuInSe}_2$  solar cells are known to a person skilled in the art, they are not known for a spherical component, but rather as a large, flat component.

Therefore, the subject matter of claim 10 is regarded as novel and inventive (PCT Article 33(2))

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Box No. V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement

and (3)).

5.) Claims 11-20 are dependent on claim 10 and therefore likewise meet the PCT requirements for novelty and inventive step.

6.) The present application meets the requirements of PCT Article 33(2) and (3), because the subject matter of independent claims 21 and 28 is novel and inventive. D3 discloses a method for producing a solar cell with spherical semiconductor components, involving the following steps:

- a) introducing several spherical semiconductor components into a glass sheet, the semiconductor components protruding from the surface of the glass sheet, at least on one side thereof;
- b) removal of parts of the semiconductor components on one side of the glass sheet;
- c) applying a back contact layer to the side of the glass sheet on which parts of the semiconductor components have been removed;
- d) applying a front contact layer to the side of the glass sheet on which no parts of the semiconductor components have been removed (see D3, figures 4-11; column 3, lines 63-column 6, line 47).

Therefore, the subject matter of claim 21 differs from the method known from D3 in that the spherical semiconductor components are made of a substrate core coated with at least one conductive back contact layer and a I-III-VI compound semiconductor layer, and that the parts of the semiconductor



## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability:  
citations and explanations supporting such statement

components are removed in such a manner that one surface of the conductive back contact layer of the semiconductor components is exposed.

These special features of the method according to claim 21 are not known from the cited prior art. They are not obvious to a person skilled in the art either, because the special structure of the spherical I-III-VI compound semiconductor components with the conductive back contact layer is not known.

Therefore, the subject matter of claim 21 is regarded as novel and inventive (PCT Article 33(2) and (3)).

Using a similar line of reasoning, the subject matter of claim 28 (solar cell from the method according to claim 21) is likewise regarded as novel and inventive (PCT Article 33(2) and (3)).

7.) Claims 22-27 and 29-39 are dependent on claims 21 and 28, respectively, and therefore likewise meet the PCT requirements for novelty and inventive step.

8.) The photovoltaic module in claim 40 has solar cells according to claims 28 to 39 and is therefore regarded as novel and inventive (PCT Article 33(2) and (3)).

9.) The subject matter of claims 1-40 meets the requirements of PCT Article 33(4) because it is industrially applicable.